

TREND FORECASTING OF TWITTER FOLLOWERS FOR PLAN INTERNATIONAL

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ABSTRACT

Plan International is working globally in more than 70 countries for the benefit of the rights of children and girls. Present study is an effort to analyze the Twitter profile of Plan International Headquarter and few regional offices for the period from July 2014 to June 2016. Social media is used by many commercial organizations to communicate their work or promoting their products to prospective customers. For the study 6 regional offices of Plan International were studied namely IH (International headquarters of Plan International), RESA (Region of Eastern and Southern Africa for Plan International), ARO (Asia's Regional Office for Plan International), WARO (Western Africa Regional Office for Plan International), ROA (Region Office of America for Plan International) and EU (European Union office for Plan International). ARIMA forecasting technique was used to predict the followers for coming 6 months (June 2016-December 2016) for regional offices and International Headquarters of Plan International. Various campaigns which contributed to success on Twitter for Plan International were "Education", "End FGM", "Child rights", "End to child trafficking", "Child Marriage", "Child Mothers", "Because I am a girl", "Global goals" and celebrating international days like "Mother's Day", "Women's day", "Menstrual Hygiene Day" etc. IH was most progressive profile of Plan International since they organized campaigns on regional and global level. Study shows that ARIMA model can be used by NGOs to forecast the follower base of their profiles and to design the campaigns accordingly. Higher Twitter follower base helps to attract higher funds, grants and sponsors for various welfare projects.

KEYWORDS: ARIMA Model, NGO, Twitter Followers, Engagement Rate, Education, End FGM, Child Rights, End to Child Trafficking & Child Marriage

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INTRODUCTION

Plan International is working globally in more than 70 countries for the benefit of the rights of children and girls. Plan International was founded in 1937 and is having a privilege of being one of the oldest and largest international development agencies in the world. Millions of people around the globe are working in partnership with Plan International to eradicate poverty. It is a not for profit organization aiming to alter the lives of 100 million girls over the next 5 years. Plan International is trying to make a lifelong impact on the lives of the most helpless and excluded children and also encouraging greater equality for girls. It is working to strengthen the position of girls in society along with its efforts to improve their daily lives. Its philosophy is to provide the rights of children and girls in all contexts especially the situations where girls are at the most risks and danger. It runs many programmes against discriminatory norms, policies and laws which are against the girls. It boosts the confidence of children especially girls by understanding their needs and listening to their views.

It is working in effective partnership with governments to encourage them to provide the rights to the children and girls. It is raising the voice to highlight the causes of violations of rights to children and discrimination or inequality. This is achieved by extending the scope beyond the communities that Plan International work for. It works for education, skills and work, youth activism, sexual health and rights, early childhood, ending violence and emergencies. "Because I am a Girl" is Plan International's global initiative to end gender inequality, and promote girls' rights and lift millions of girls, their families and communities out of poverty. The aims of this campaign are to improve girls' access to clean water, food, healthcare, education, and protection from violence and exploitation. Plan International uses all social media platforms like Facebook, Twitter, LinkedIn, Instagram, YouTube and Pinterest to update the work and efforts it is making to empower girls and promote gender equality. Present study is an effort to analyze the Twitter profile of Plan International Headquarter and few regional offices for the period from July 2014 to June 2016. Social media is used by many commercial organizations to communicate their work or promoting their products to prospective customers. Hence many incidences of using social media to predict the followers can be found but the previous studies related to use of social media for prediction of followers especially in the case of NGOs are very scarce. Few studies of uses of social media and their analysis for social concerns are mentioned below.

Wang & Zhuang (2017) studied information distribution and coverage of social media during disasters. The paper analyzed 986,579 tweets posted during Hurricane Sandy (October 22 to November 6, 2012). The samples consisted of 163 governmental organizations (GO), 31 non-governmental organizations (NGO) and 276 news agent accounts and their tweets for analysis. The analysis was done by studying five social media key performance indicators (KPIs) that included impression, like, mention, re-tweet, and response time. In addition to KPIs other variables such as hashtag, tweet frequency, and information type were also studied. Results showed that there was a significant difference among different user types on the basis of total impression, re-tweet rate, hashtag, and tweet frequency. In case of total impressions and tweets news agent generated larger number than GO and NGO users but their re-tweet rates and number of hashtags are lower than the GO and NGO users. This paper provided a new way of using social media for communicating during crises. Culotta (2010) analyzed over 500 million Twitter messages from an eight month period. The studies found that future influenza rates can be forecasted with high accuracy by tracking a small number of flu-related keywords and the results were having an accuracy of 95% correlation with national health statistics. The analysis of robustness of this approach was done for spurious keyword matches, and author proposed a document classification component to filter these misleading messages which was found to be effective in reducing error rates by over half in simulated false alarm experiments. The author suggested more research to develop methods that are robust in cases of extremely high noise. Morley (1993) emphasized the problem of using regression analysis for forecasting purpose and hence recommended the use of extrapolative time series methods. In investigating the use of such methods, author recommended the use of ARIMA model as it provides better results than simpler Holt-Winters model. Although author raised some concerns related to final ARIMA model. He concluded that final ARIMA model and forecasts are sensitive to the analysts as well as to change in the data period and frequency.

Hossain, Samad, & Ali (2010) generated three types of forecasts, namely, historical, ex-post and ex-ante, using the world famous Box-Jenkins time series models for motor, mash and mung prices in Bangladesh. Six important criteria were used in the model for these forecasts. The authors found that forecasting accuracy of the model were quite satisfactory. They suggested the use of this model for policy purpose in the case of forecasting of price of commodities. Shrivastav & Ekata (2012) analyzed the crime data of Gujarat State pertaining to counterfeiting of currency by using Box

Jenkins ARIMA model for short term crime forecasting. The authors found that crime forecasting is an interesting application area of research and ARIMA model offers a good technique for predicting the magnitude of any variable. The model developed for crime forecasting was found to be ARIMA(1,1,1). Lean, Shouyang, Lai, & Nakamori (2005) proposed a set of computational procedures to solve the issues related to selection of forecasting model. The author also proposed a novel modeling technique to overcome the problems of current combined forecasting methods. The simulations and real data were used to confirm the efficiency and reliability of the proposed procedure and modeling technique. They concluded that the proposed procedure and modeling technique can be used as a feasible solution for time series forecasting with multiple candidate models.

METHODOLOGY

Source of data: Secondary data was manually collected by researcher from profile of regional offices and International Headquarters of Plan International on 1st day of each month from July 2014 to June 2016 to keep a track of month wise increase of Twitter followers, which provided the base for forecasting.

Twitter Engagement Rate was calculated using the formula: $\text{No. of retweets} + \text{replies} / \text{Total no. of followers} * 100$

For the study 6 regional offices of Plan International were studied namely IH (International headquarters of Plan International), RESA (Region of Eastern and Southern Africa for Plan International), ARO (Asia's Regional Office for Plan International), WARO (Western Africa Regional Office for Plan International), ROA (Region Office of America for Plan International) and EU (European Union office for Plan International)

Technique used: ARIMA forecasting technique was used to predict the followers for coming 6 months (June 2016-December 2016) for regional offices and International Headquarters of Plan International. ARIMA models are applied when data show evidence of non-stationarity, where an initial differencing step (corresponding to the "integrated" part of the model) can be applied one or more times to eliminate the non-stationarity. The AR part of ARIMA indicates that the evolving variable of interest is regressed on its own lagged values. The MA part indicates that the regression error is actually a linear combination of error terms whose values occurred contemporaneously and at various times in the past. I (for "integrated") indicate that the data values have been replaced with the difference between their values and the previous values. The purpose of each of these features is to make the model fit the data as well as possible. When two out of the three terms are zeros, the model may be referred to base on the nonzero parameter, dropping "AR", "I" or "MA" from the acronym describing the model. For example, ARIMA (1,0,0) is AR(1), ARIMA(0,1,0) is I(1), and ARIMA(0,0,1) is MA(1). ARIMA models can be estimated following the Box-Jenkins approach. Given a time series of data X_t where t is an integer index and the X_t are real numbers, an ARMA (p, q) model is given by:

$$X_t - \alpha_1 X_{t-1} - \dots - \alpha_{p'} X_{t-p'} = \varepsilon_t + \theta_1 \varepsilon_{t-1} + \dots + \theta_q \varepsilon_{t-q}$$

Where L is the lag operator, α are the parameters of the autoregressive part of the model are the parameters of the moving average part and ε_t are error terms. The error terms are generally assumed to be independent, identically distributed variables

RESULTS AND DISCUSSION

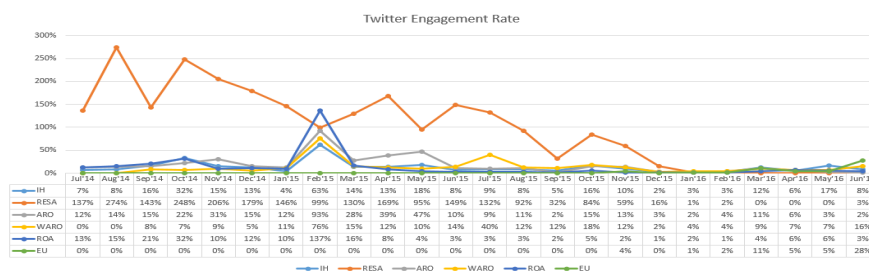


Figure 1: Twitter Engagement Rate (Jul'16-Dec'16)

Twitter Engagement rate tells about the overall engagement of followers and activity (retweets and replies) they made on particular twitter page. By Twitter activity, we consider number of retweets and replies made in a particular month in response of tweets posted by user. In case of Plan International, RESA had highest twitter engagement rate since they posted limited number of tweets but got higher audience response in form of retweets and replies. They made most of the tweets related to 'Ebola awareness', 'End Female Genital Mutilation', 'Child marriage' etc. IH also had good engagement rate due to campaigns like 'Save Girl Child', 'Because I am a girl', 'End Child Marriage', 'Girls not brides', 'Child education' etc.

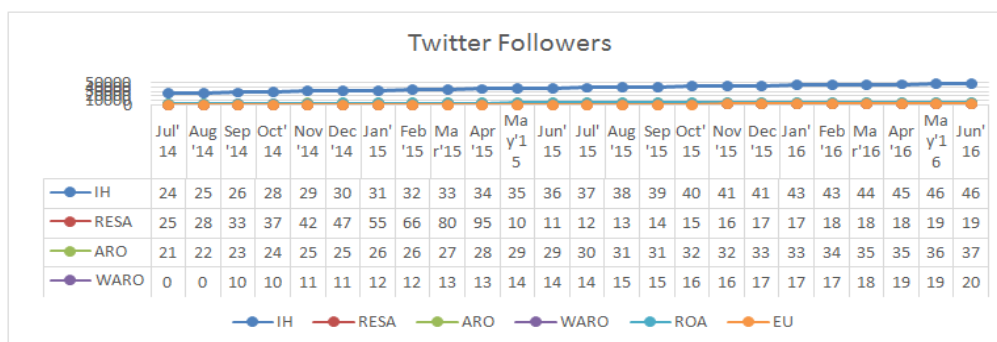


Figure 2: Twitter Followers (Jul'16-Dec'16)

IH had maximum followers since it was International headquarters of Plan International. They had followers from all over the world. Their most successful campaigns which helped to increase their follower base were 'Child rights', 'Child education', 'Child Safety', 'Girl education', 'Women Empowerment', 'Child marriage' etc. After IH (International headquarters), ROA (Region Office of America) and ARO (Asia's Regional Office) had highest number of followers since internet connectivity and awareness about the projects of Plan International was higher in the areas which fall under ROA and ARO. WARO (Western Africa Regional Office) and RESA (Region of Eastern and Southern Africa) got lowest number of followers since most of the regions of Africa were backward and lacked internet facilities and awareness about profiles of Plan International. EU (European Union) Twitter fan page was created in November 2015, but from (November 2015-June 2017), it attracted high number of Twitter followers.

FORECAST OF TWITTER FOLLOWERS FOR 6 MONTHS (JUL'16-DEC'16) BASED ON DATA COLLECTED FROM JUL'14-JUN'16

IH (International Headquarters of Plan International)

- ARIMA (0,1,0) with drift
- **Coefficients:** Drift=969.6087, s. e. =54.7907, σ^2 estimated as 72210: log likelihood=-160.77, AIC=325.55, AIC c=326.15, BIC=327.82
- **Training Set Error Measures:** ME=0.9884741, RMSE =257.2795, MAE=184.7312, MPE=0.04849072, MAPE=0.545449, MASE=0.1905214, ACF1=0.1588985

Table 1: Forecast of IH (International Headquarters of Plan International) Twitter Followers (Jul'16-Dec'16)

Month	Predicted No. of Followers	Followers at 80% Confidence Interval		Followers at 95% Confidence Interval	
		Lower	Higher	Lower	Higher
1 (Jul'16)	47963.61	47619.23	48307.99	47436.93	48490.29
2 (Aug'16)	48933.22	48446.19	49420.24	48188.38	49678.06
3 (Sep'16)	49902.83	49306.35	50499.31	48990.59	50815.06
4 (Oct'16)	50872.43	50183.68	51561.19	49819.07	51925.8
5 (Nov'16)	51842.04	51071.99	52612.1	50664.35	53019.74
6 (Dec'16)	52811.65	51968.1	53655.2	51521.55	54101.75

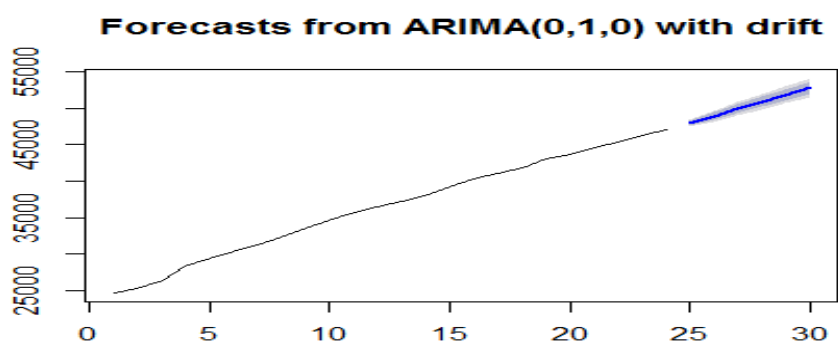


Figure 1: Graphical: Forecast of IHT Witter Followers (Jul'16-Dec'16)

Using ARIMA (0, 1, 0) number of followers were predicted for IH for 6 months. It was predicted that followers would grow at rate of 9%. In Jun'16 number of followers was 4699, which were expected to grow to 52811 by Dec'16. Major campaigns of IH were 'Child rights', 'Child education', 'Child Safety', 'Girl education', 'Women Empowerment', 'Child marriage' etc.

RESA (Region of Eastern and Southern Africa for Plan International)

- ARIMA(1,1,0)
- **Coefficients:** Drift=0.9403, s.e.=0.0482, σ^2 estimated as 554.1: log likelihood=-105.85, AIC=215.7 AICc=216.3, BIC=217.97
- **Training Set Error Measures:** ME=5.311136, RMSE=22.5365, MAE=6 17.11244, MPE=1.155913, MAPE=1.968499, MASE=0.227638, ACF1=0.01240045

Table 2: Forecast of RESA (Region of Eastern and Southern Africa for Plan International) Twitter Followers (Jul'16-Dec'16)

Month	Predicted No. of Followers	Followers at 80% Confidence Interval		Followers at 95% Confidence Interval	
		Lower	Higher	Lower	Higher
1 (Jul'16)	2026.554	1996.388	2056.72	1980.419	2072.688
2 (Aug'16)	2062.807	1996.958	2128.655	1962.1	2163.513
3 (Sep'16)	2096.896	1989.212	2204.581	1932.207	2261.586
4 (Oct'16)	2128.952	1974.812	2283.092	1893.215	2364.689
5 (Nov'16)	2159.095	1954.936	2363.254	1846.86	2471.33
6 (Dec'16)	2187.439	1930.471	2444.407	1794.44	2580.438

Forecasts from ARIMA(1,1,0)

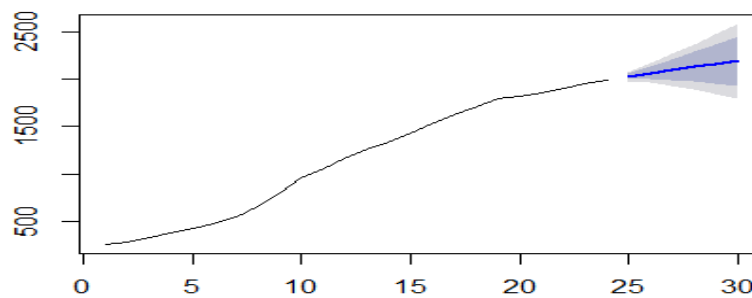


Figure 2: Graphical: Forecast of RESA Twitter Followers (Jul'16-Dec'16)

Using ARIMA (1, 1, 0) number of followers were predicted for RESA for months. It was predicted that followers would grow at rate of 91%. In Jun'16 number of followers was 1988, which were expected to grow to 2187 by Dec'16. Major campaigns of RESA were 'WASH (clean water for health & hygiene)', 'Child marriage', 'Self-help groups', 'Women empowerment', 'End FGM' and 'End to violence'.

ARO (Asia's Regional Office for Plan International)

- ARIMA(0, 1, 0) with drift
- **Coefficients:** Drift=66.8696, s. e.=4.0261, sigma² estimated as 390: log likelihood=-100.73, AIC=205.46, AIC c=206.06, BIC=207.73
- **Training Set Error Measures:** ME=0.08817206, RMSE=18.90666, MAE=15.61353, MPE=0.02937202, MAPE=0.5426395, MASE=0.2334924, ACF1=0.1605583

Table 3: Forecast of ARO (Asia's Regional Office for Plan International) Twitter Followers (Jul'16-Dec'16)

Month	Predicted No. of Followers	Followers at 80% Confidence Interval		Followers at 95% Confidence Interval	
		Lower	Higher	Lower	Higher
1 (Jul'16)	3787.87	3762.562	3813.177	3749.165	3826.574
2 (Aug'16)	3854.739	3818.949	3890.529	3800.003	3909.475
3 (Sep'16)	3921.609	3877.775	3965.442	3854.571	3988.646
4 (Oct'16)	3988.478	3937.864	4039.093	3911.07	4065.887
5 (Nov'16)	4055.348	3998.759	4111.937	3968.803	4141.893
6 (Dec'16)	4122.217	4060.227	4184.207	4027.412	4217.023

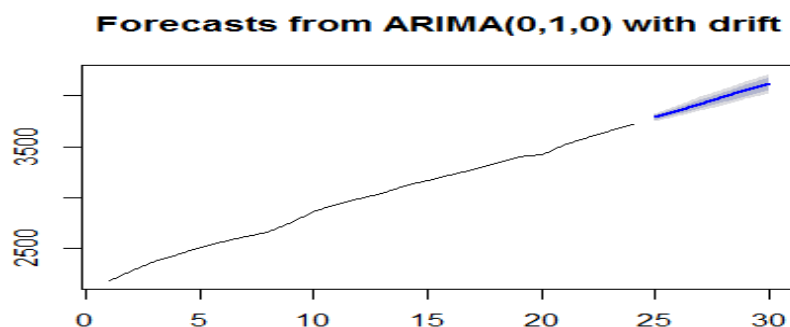


Figure 3: Graphical: Forecast of ARO Twitter Followers (Jul'16-Dec'16)

Using ARIMA (0, 1, 0) number of followers were predicted for ARO for 6 months. It was predicted that followers would grow at rate of 90%. In Jun'16 numbers of followers were 3721, which were expected to grow to 4122 by Dec'16. Major campaigns of ARO were 'Aid by Plan International to Nepal earthquake victims', 'Child marriage', 'Girls not brides', 'Women empowerment', 'End to violence', 'My daughter My power', 'End to child trafficking'.

WARO (Western Africa Regional Office for Plan International)

- ARIMA(0,1,0) with drift
- **Coefficients:** Drift=88.3478, s. e. 41.0836, σ^2 estimated as 40585: log likelihood=-154.15, AIC=312.31, AIC c=312.91, BIC=314.58
- **Training Set Error Measures:** ME=0.003681158, RMSE=192.8809, MAE=76.7247, MASE=0.868439, ACF1=0.06175484

Table 4: Forecast of WARO (Western Africa Regional Office for Plan International) Twitter Followers (Jul'16-Dec'16)

Month	Predicted No. of Followers	Followers at 80% Confidence Interval		Followers at 95% Confidence Interval	
		Lower	Higher	Lower	Higher
1 (Jul'16)	2120.348	1862.17	2378.526	1725.498	2515.197
2 (Aug'16)	2208.696	1843.576	2573.815	1650.294	2767.097
3 (Sep'16)	2297.043	1849.866	2744.221	1613.144	2980.943
4 (Oct'16)	2385.391	1869.035	2901.748	1595.692	3175.09
5 (Nov'16)	2473.739	1896.435	3051.043	1590.829	3356.65
6 (Dec'16)	2562.087	1929.682	3194.492	1594.907	3529.267

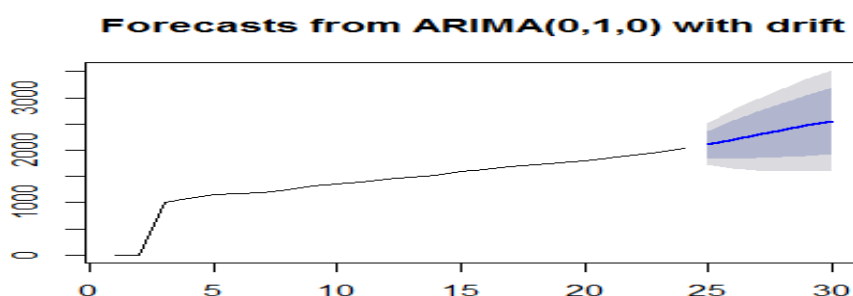


Figure 4: Graphical: Forecast of WARO Twitter Followers (Jul'16-Dec'16)

Using ARIMA (0, 1, 0) number of followers were predicted for WARO for next 6 months. It was predicted that followers would grow at rate of 79%. Jun'16 number of followers was 2032, which were expected to grow to 5662 by

Dec'16. Major campaigns of WARO were because i am a Girl', 'End Child Labour', 'Child rights', 'Day of The African Child', 'World Refugee Day', 'End Child Marriage', 'Let Girls Learn', 'Global Goals', 'Girls in emergencies', 'Educating Girls', 'Ebola' and 'Sexual Violence in Schools'.

ROA (Region Office of America for Plan International)

- ARIMA(0,2,1)
- **Coefficients:** Drift= 0.7698, s. e.=0.1399, σ^2 estimated as 608.6: log likelihood=-101.66, AIC=207.32, AIC c=207.96, BIC=209.51
- **Training Set Error Measures:** ME=2.816063, RMSE=23.07717, MAE =17.02699, MPE=-0.05246813, MAPE=0.4490462, MASE=0.234644, ACF1=0.3389465

**Table 5: Forecast of ROA (Region Office of America for Plan International)
Twitter Followers (Jul'16-Dec'16)**

Month	Predicted No. of Followers	Followers at 80% Confidence Interval		Followers at 95% Confidence Interval	
		Lower	Higher	Lower	Higher
1 (Jul'16)	4794.7	4763.115	4826.348	4746.378	4843.085
2 (Aug'16)	4856.463	4806.34	4906.586	4779.806	4933.119
3 (Sep'16)	4918.194	4850.047	4986.341	4813.972	5022.416
4 (Oct'16)	4979.925	4893.319	5066.532	4847.473	5112.378
5 (Nov'16)	5041.657	4935.883	5147.431	4879.89	5203.424
6 (Dec'16)	5103.388	4977.642	5229.135	4911.075	5295.701

Forecasts from ARIMA(0,2,1)

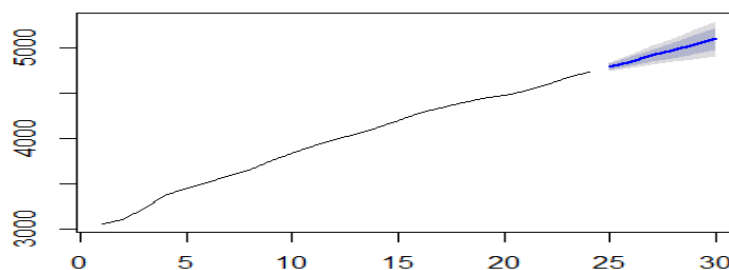


Figure 5: Graphical: Forecast of ROA Twitter Followers (Jul'16-Dec'16)

Using ARIMA (0, 2, 1) number of followers were predicted for ROA for 6 months. It was predicted that followers would grow at rate of 93%. In Jun'16 numbers of followers were 4733, which were expected to grow to 5103 by Dec'16. Major campaigns of ROA were 'PorSerNiña', 'Girl protection', 'Ecuador Earthquake', 'Child rights', 'Child Education', 'Against Cyber Bullying', 'Education in a safe environment' and 'Nicaragua Earthquake'.

EU (European Union Office for Plan International)

- ARIMA(0,0,0) with non-zero mean
- **Coefficients:** Drift=1447.2222, s. e.=172.1031, σ^2 estimated as 104311: log likelihood=-68.99, AIC=141.98, AIC c=142.55, BIC=144.34
- **Training Set Error Measures:** ME=2.779135e, RMSE=-13 516.3061, MAE=321.6049, MASE=1.454403, ACF1=0.03861101

Table 6: Forecast of EU (European Union Office for Plan International) Twitter Followers (Jul'16-Dec'16)

Month	Predicted No. of Followers	Followers at 80% Confidence Interval		Followers at 95% Confidence Interval	
		Lower	Higher	Lower	Higher
1 (Jul'16)	1447.2	1033.317	1861.127	814.2092	2080.235
2 (Aug'16)	1447.222	1033.317	1861.127	814.2092	2080.235
3 (Sep'16)	1447.222	1033.317	1861.127	814.2092	2080.235
4 (Oct'16)	1447.222	1033.317	1861.127	814.2092	2080.235
5 (Nov'16)	1447.222	1033.317	1861.127	814.2092	2080.235
6 (Dec'16)	1447.222	1033.317	1861.127	814.2092	2080.235

Forecasts from ARIMA(0,0,0) with non-zero mean

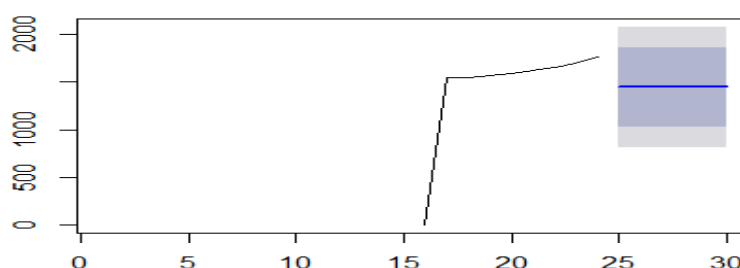


Figure 5: Graphical: Forecast of EU Twitter Followers (Jul'16-Dec'16)

Using ARIMA (0, 0, 0) number of followers were predicted for EU for 6 months. Major campaigns of EU were 'Girls Rights', 'Global Goals', 'Gender Equality', 'End to Child Labour', 'Girls Voices', 'Empower Women', 'Goals for girls'. Due to lack of data for EU, accurate forecasting of followers data cannot be obtained.

CONCLUSIONS

Social media plays an important role in popularity of any organization and to attract followers. It is an effective and low cost medium for advertisement. Twitter user base can be used efficiently to gain popularity and to attract sponsors and funds for various campaigns by NGOs. Various campaigns which contributed to success on Twitter for Plan International were "Education", "End FGM", "Child rights", "End to child trafficking", "Child Marriage", "Child Mothers", "Because I am a girl", "Global goals" and celebrating international days like "Mother's Day", "Women's day", "Menstrual Hygiene Day" etc. IH was most progressive profile of Plan International since they organized campaigns on regional and global level. IH prepared attractive tweets on Twitter to get high audience attention. Apart from IH, other progressive profiles were ROA and ARO. Both these profiles had high followers base due to their international and local campaigns. Other profiles mostly tweet about their local campaigns, thus their follower base is limited to few countries. ARIMA model can be used by NGOs to forecast the follower base of their profiles and to design the campaigns accordingly. Higher Twitter follower base helps to attract higher funds, grants and sponsors for various welfare projects.

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